

CLAIMS

1. An submarine boat provided with a fuel cell for power generation by supply of hydrogen and oxidizing agent, a hydrogen generating device for generating a gas containing hydrogen to be supplied to the fuel cell, and a propelling device driven by electricity generated by the fuel cell, characterized in that the hydrogen generating device is to generate a gas containing hydrogen by decomposing a fuel containing an organic compound, comprising a partition membrane, a fuel electrode provided on one surface of the partition membrane, means for supplying a fuel containing the organic compound and water to the fuel electrode, an oxidizing electrode provided on the other surface of the partition membrane, means for supplying an oxidizing agent to the oxidizing electrode, and means for generating and collecting the gas containing hydrogen from the fuel electrode.

2. The submarine boat as described in Claim 1, wherein the hydrogen generating device is an open circuit having neither means for withdrawing electric energy to outside from a hydrogen generating cell constituting the hydrogen generating device, nor means for providing electric energy from outside to the hydrogen generating cell.

3. The submarine boat as described in Claim 1, wherein the hydrogen generating cell in the hydrogen

generating device has means for withdrawing electric energy to outside with the fuel electrode serving as a negative electrode and the oxidizing electrode as a positive electrode.

4. The submarine boat as described in Claim 1, wherein the hydrogen generating cell in the hydrogen generating device has means for providing electric energy from outside with the fuel electrode serving as cathode and the oxidizing electrode as anode.

5. The submarine boat as described in Claim 1, wherein two or more of hydrogen generating devices selected from a group consisting of a hydrogen generating device, which is an open circuit having neither means for withdrawing electric energy to outside from a hydrogen generating cell, nor means for providing electric energy from outside to the hydrogen generating cell, a hydrogen generating device having means for withdrawing electric energy to outside with the fuel electrode of the hydrogen generating cell serving as a negative electrode and the oxidizing electrode of the cell as a positive electrode, and a hydrogen generating device having means for providing electric energy from outside with the fuel electrode of the hydrogen generating cell serving as cathode and the oxidizing electrode of the cell as anode are combined in use.

6. The submarine boat as described in Claim 1, wherein voltage between the fuel electrode and the

oxidizing electrode is 200 to 1000 mV in the hydrogen generating device.

7. The submarine boat as described in Claim 2, wherein voltage between the fuel electrode and the oxidizing electrode is 300 to 800 mV in the hydrogen generating device.

8. The submarine boat as described in Claim 3, wherein voltage between the fuel electrode and the oxidizing electrode is 200 to 600 mV in the hydrogen generating device.

9. The submarine boat as described in Claim 3, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the volume of electric energy withdrawn from the hydrogen generating device.

10. The submarine boat as described in Claim 4, wherein voltage between the fuel electrode and the oxidizing electrode is 300 to 1000 mV in the hydrogen generating device.

11. The submarine boat as described in Claim 4, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the volume of electric energy provided in the hydrogen generating device.

12. The submarine boat as described in any one of Claims 1 to 11, wherein the evolution volume of hydrogen-containing gas is adjusted by varying voltage between the fuel electrode and the oxidizing electrode in the hydrogen generating device.

13. The submarine boat as described in any one of Claims 1 to 11, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the supply volume of the oxidizing agent in the hydrogen generating device.

14. The submarine boat as described in Claim 12, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the supply volume of the oxidizing agent in the hydrogen generating device.

15. The submarine boat as described in any one of Claims 1 to 11, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the concentration of the oxidizing agent in the hydrogen generating device.

16. The submarine boat as described in Claim 12, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the

concentration of the oxidizing agent in the hydrogen generating device.

17. The submarine boat as described in Claim 13, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the concentration of the oxidizing agent in the hydrogen generating device.

18. The submarine boat as described in any one of Claims 1 to 11, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the supply volume of fuel containing an organic compound and water in the hydrogen generating device.

19. The submarine boat as described in Claim 12, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the supply volume of fuel containing an organic compound and water in the hydrogen generating device.

20. The submarine boat as described in Claim 13, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the supply volume of fuel containing an organic compound and water in the hydrogen generating device.

21. The submarine boat as described in Claim 15,

wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the supply volume of fuel containing an organic compound and water in the hydrogen generating device.

22. The submarine boat as described in any one of Claims 1 to 11, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the concentration of fuel containing an organic compound and water in the hydrogen generating device.

23. The submarine boat as described in Claim 12, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the concentration of fuel containing an organic compound and water in the hydrogen generating device.

24. The submarine boat as described in Claim 13, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the concentration of fuel containing an organic compound and water in the hydrogen generating device.

25. The submarine boat as described in Claim 15, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the

concentration of fuel containing an organic compound and water in the hydrogen generating device.

26. The submarine boat as described in Claim 18, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the concentration of fuel containing an organic compound and water in the hydrogen generating device.

27. The submarine boat as described in any one of Claims 1 to 11, wherein the operation temperature of the hydrogen generating device is not higher than 100°C.

28. The submarine boat as described in Claim 27, wherein the operation temperature is between 30 and 90°C.

29. The submarine boat as described in Claim 12, wherein the operation temperature of the hydrogen generating device is not higher than 100°C.

30. The submarine boat as described in Claim 13, wherein the operation temperature of the hydrogen generating device is not higher than 100°C.

31. The submarine boat as described in Claim 15, wherein the operation temperature of the hydrogen generating device is not higher than 100°C.

32. The submarine boat as described in Claim 18, wherein the operation temperature of the hydrogen generating device is not higher than 100°C.

33. The submarine boat as described in Claim 22, wherein the operation temperature of the hydrogen

generating device is not higher than 100°C.

34. The submarine boat as described in any one of Claims 1 to 11, wherein the organic compound supplied to the fuel electrode of the hydrogen generating device is one or two or more organic compounds selected from a group consisting of alcohol, aldehyde, carboxyl acid and ether.

35. The submarine boat as described in Claim 34, wherein the alcohol is methanol.

36. The submarine boat as described in any one of Claims 1 to 11, wherein the oxidizing agent supplied to the oxidizing electrode of the hydrogen generating device is an oxygen-containing gas or oxygen.

37. The submarine boat as described in Claim 36, wherein the oxidizing agent supplied to the oxidizing electrode of the hydrogen generating device is an oxygen-off gas exhausted from the fuel cell or the hydrogen generating device.

38. The submarine boat as described in any one of Claims 1 to 11, wherein the oxidizing agent supplied to the oxidizing electrode of the hydrogen generating device is a liquid containing hydrogen peroxide solution.

39. The submarine boat as described in any one of Claims 1 to 11, wherein the partition membrane of the hydrogen generating device is a proton conducting solid electrolyte membrane.

40. The submarine boat as described in Claim 39, wherein the proton conducting solid electrolyte membrane is

a perfluorocarbon sulfonate-based solid electrolyte membrane.

41. The submarine boat as described in any one of Claims 1 to 11, wherein a catalyst of the fuel electrode of the hydrogen generating device is made of platinum-ruthenium alloy supported by carbon powder serving as a base.

42. The submarine boat as described in any one of Claims 1 to 11, wherein a catalyst of the oxidizing electrode of the hydrogen generating device is made of platinum supported by carbon powder serving as a base.

43. The submarine boat as described in any one of Claims 1 to 11, wherein means for circulating fuel containing an organic compound and water is provided at the hydrogen generating device.

44. The submarine boat as described in any one of Claims 1 to 11, wherein a carbon dioxide absorbing portion for absorbing carbon dioxide contained in the generated hydrogen-containing gas is provided at the hydrogen generating device.

45. The submarine boat as described in any one of Claims 1 to 11, wherein the hydrogen-containing gas generated from the hydrogen generating device is supplied to the fuel cell without being cooled.

46. The submarine boat as described in any one of Claims 1 to 11, wherein an insulating material for insulating a heat generated by the hydrogen generating

device is not provided.